48V 1500W BLDC MOTOR DRIVER

BLD1500RA User Manual

Dongguan ICAN Technology Co., Ltd

LOW VOLTAGE HIGH POWER DRIVER
BLD1500RA

1 Profile

BLD1500RA brush less DC motor driver is independently developed by Dongguan ICAN Tech Technology Co., Ltd. It is a high-performance and low-cost brushless driver for 1500W low-voltage brushless DC motor. The DC brushless driver supports Modbus communication protocol and motor deceleration braking function, providing users with more flexible choices in practical applications.

- ACC/DEC time setting
- Phase current limiting adjust
- Motor speed setting/ close loop setting/pole pairs setting
- Multiple speed control
- Speed of revolution tolerance is ±0.01%
- Alarm signal
- Supporting Modbus communication and suitable for PC control by user.
- Connecting Resistance braking

2 Electrical properties and environmental indicators

2.1Electrical properties

Driver parameter	Min Value	Typical Value	Max value	Unit
Current input (A)	-	40	-	A
Voltage input DC(V)	20	48	50	V
Current limit(A)	22	-	82	A
Output Power(W)	-	1500	1500	W
Apply speed	-	3000	-	rpm
The parameters of this table are suitable for normal temperature 25 ℃				

2.2 Environmental indicators

Heat sinking Method	Natural cooling or fan-forced cooling
Used occasion	Avoid dust,oily mist and corrosive air
Operating Temperature	-20℃~+40℃
Storage Temperature	-30℃~+50℃
Dielectric Strength	500VAC

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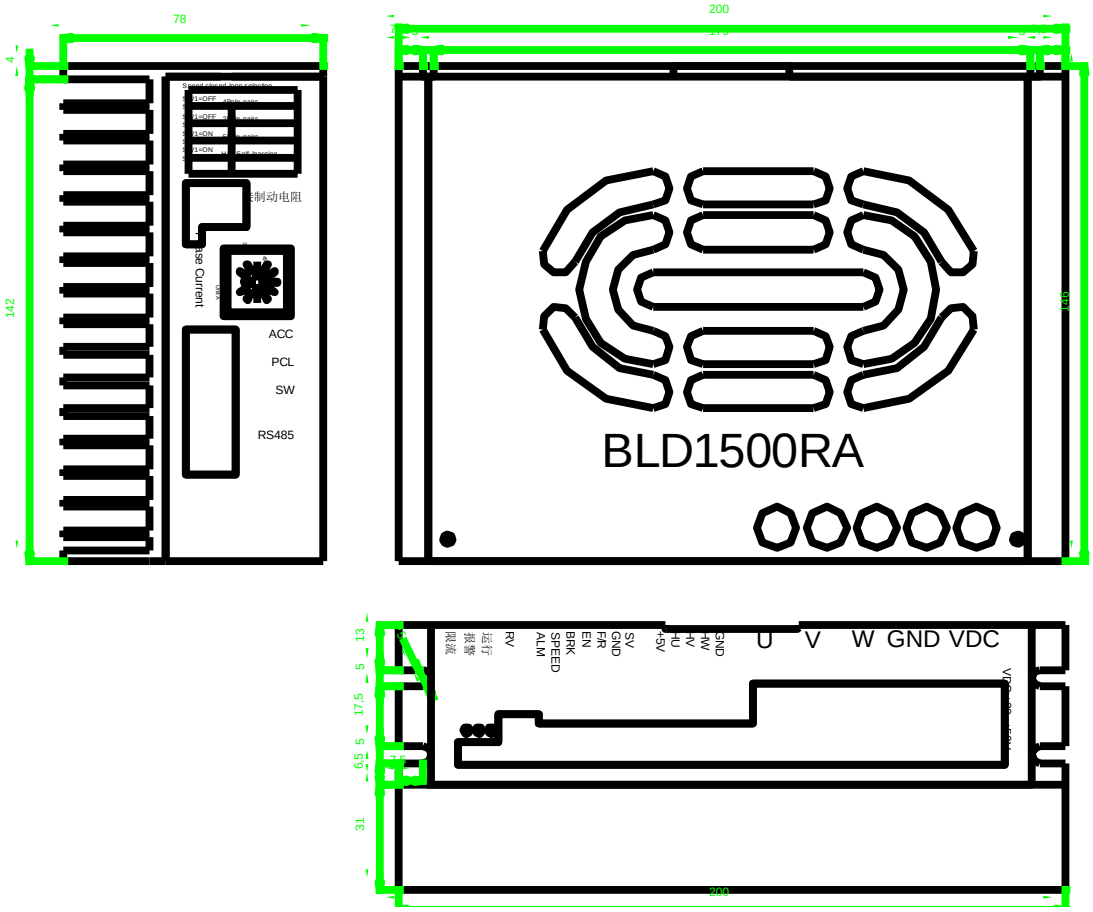
78
200
142
106
ACC
PCL
SW
RS485
BLD1500RA
U V W GND VDC
RV
SPEED
ALM
BRK
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F/R
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+5V
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13
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17.5
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6.5
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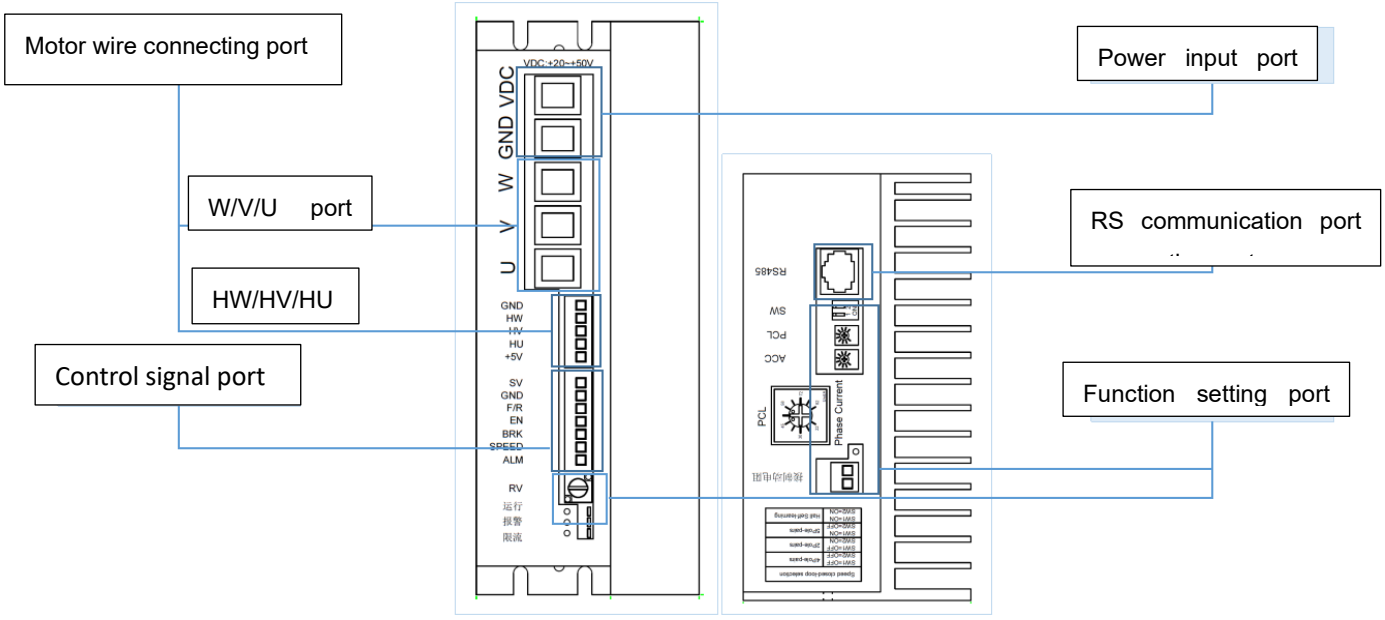
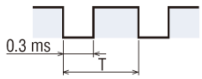
4

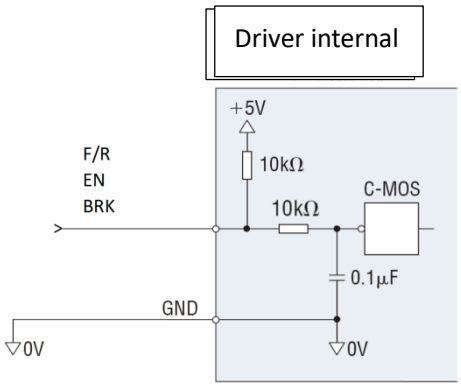

Motor wire connecting port
W/V/U port
HW/HV/HU
Control signal port
Power input port
RS communication port
Function setting port
VDC
GND
W
V
U
RS485
SW
PCL
ACC
Phase Current

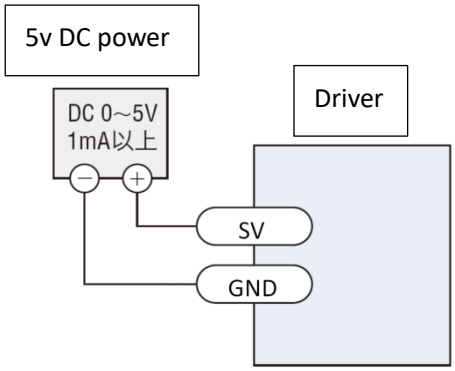
4.2 Port signal description

Signal category	Terminal	Functional Description
Power connection	VDC	DC Power supply positive electrode
	GND	DC Power supply negative electrode
Motor connection	U	Motor line U phase
	V	Motor line V phase
	W	Motor line W phase
Motor Hall signal	+5V	BLDC Hall signal power positive pole
	HU	Hall sensor signal HU
	HV	Hall sensor signal HV
	HW	Hall sensor signal HW
	GND	BLDC Hall signal power negative electrode
Control signal	SV	External speed setting signal input terminal;
	EN	Motor stop signal port: When EN and GND disconnect, motor stops slowly while when they connect, motor runs.
	F/R	Motor direction control terminal: F/R and GND disconnect, motor will rotate clockwise, and otherwise, motor will rotate anticlockwise.
	BRK	Motor brake stop control port; when BRK and GND disconnect, motor run, otherwise, the motor stop
	GND	Control signal grounding screw (common port)
Output signal (connect Pull up resistance 2K-20K)	SPEED	Pulse frequency output corresponded with running speed. Speed can be figured out according N(rpm)= (F/P)×10 F:Output pulse frequency（Hz）; P:Motor pole pairs; N:Motor speed For example: Motor has 4 pole pairs F=500Hz N(rpm)=(500/4)×10=1250 
	ALM	Alarm signal output port. When fault occurs, the voltage changes to 0V from 5V.
Built in control signal	ACC	Acceleration and deceleration time adjustment (Factory default minimum)
	PCL	Phase line current limit adjustment (Factory default maximum)
	SW	Pole pairs selection and self-learn(Factory default SW1=OFF,SW2=OFF)
	Connected to braking resistance	Brake resistance connection port
	RS485	MODBUS communication connection
	RV	Built in potentiometer speed regulation
	Fan	Two built-in fans are temperature controlled fans (starting temperature 70 ℃)

4.3 Input circuit description

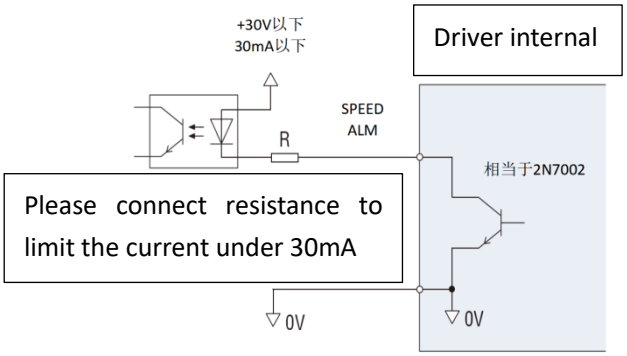
The internal structure of F / R terminal, EN terminal and BRK terminal of the driver is as follows: the low level is less than 0.5V and the high level is greater than 2.5V. The external analog SV input wiring is shown in the figure below.

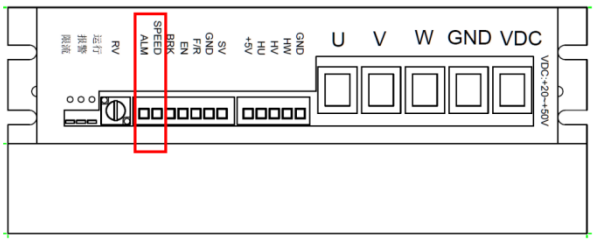




4.4 Output circuit description

The internal structure of ALM terminal and speed terminal of the driver is as follows. Its wiring mode with PLC is related to the type of PLC input terminal. For example, input modules such as AX40 / 741 / 42 / 50 / 60 of Mitsubishi a series PLC and QX40 / 41 / 42 of Q series only support the source mode, and users should connect according to the characteristics of this input type.

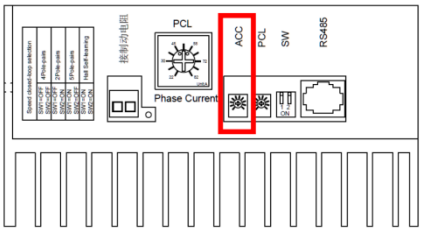




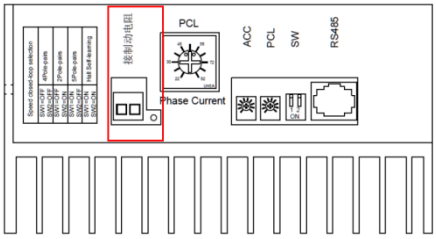
5 Function setting

5.1 ACC/DEC time setting

Setting the acceleration and deceleration time of the motor. Turning the ACC knob left and right to reduce and increase the acceleration and deceleration time respectively. The setting range is 0.6 ~ 15s. The acceleration time is the time from the stop state to the rated 3000rpm, and the deceleration time is the time from 3000rpm to the stop state



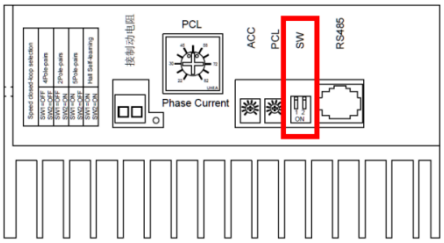
discharge resistance	
Alternative name	Discharge resistance, braking resistance, stop resistance
Recommended resistance	2.5Ωto 7.5Ω
Recommended power	500W to 1500W
Recommended type	Trapezoidal aluminum shell resistance



5.2 Motor closed loop pole pair selection

In order to correspond to the number of poles of the motor, it has the function of selecting the number of poles. When the load does not exceed the rated load, the motor speed will not be affected

4 polar closed loop：SW1=OFF,SW2=OFF
2 polar closed loop：SW1=OFF,SW2=ON
5 polar closed loop：SW1=ON,SW2=OFF
Hall self-learning：SW1=ON,SW2=ON

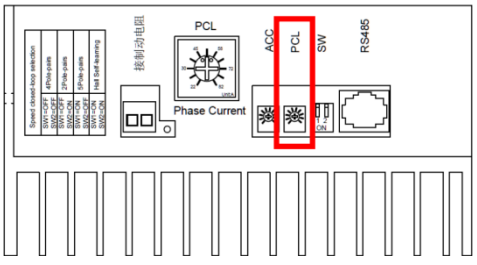


注意

Please set the SW setting corresponding to the number of motor poles.During hall self-learning, please ensure that the communication is disabled and the control signal is not input. After successful learning, the motor will run at low speed and the learning data will be lost after power failure.

5.3 Phase current limiting adjust

Adjust the PCL knob to limit the peak output current. When the load suddenly increases, the output current is output according to the set value to reduce the



motor speed

Please set the peak current according to the following figure on the right. The setting range is 22A ~ 82A (default 30A), but the actual use will be deviated by the tolerance of the knob. Therefore, for safety, please set the peak output current slightly lower

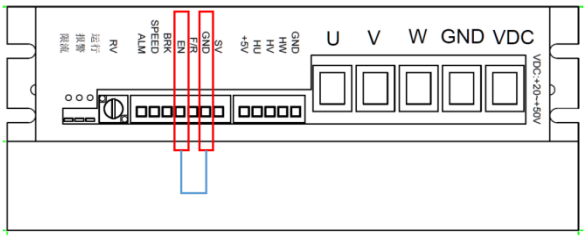
注意 When current limiting occurs, the white light will be on. At this time, please turn up the PCL knob appropriately (adjusting this knob will linearly adjust the current limiting value).

5.4 Low speed protection function

When the rotor is detained, the load rises suddenly or hits an obstacle, if the speed of the motor is less than half of the set speed, it will continue to operate for 2 seconds. If the reason restricting the rotor is solved within 2 seconds, the driver will operate as usual. After 2 seconds, if the reason for restricting the rotor is not solved, the driver stops and the under-speed alarm (this under speed time can be changed through communication)

5.5 Start and stop

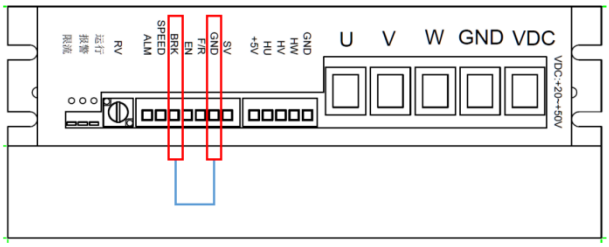
The factory setting of the product is that the EN Port is not connected to the GND port, so the driver does not drive the motor when the power is input. After connecting the EN Port wiring with the GND port wiring, the motor is allowed to run.



If a switch is installed between EN Port and GND port, the start and stop states of the motor can be simply switched

5.6 Brake

The default setting is that the BRK port is not connected with the GND port, so the driver is allowed to drive the motor after inputting the power. After connecting the BRK port with the GND port, the driver slows down and stops and brakes.



If a switch is installed between BRK port and GND port, the braking and running state of the motor can be simply switched

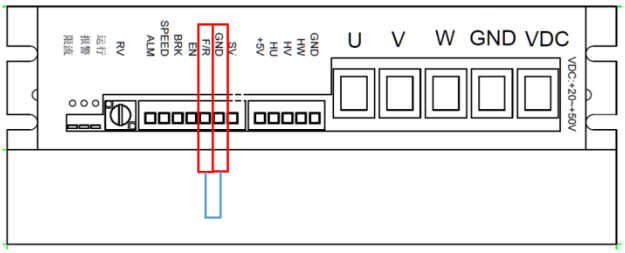
EN and BRK start modes are opposite. Although both EN and BRK can slow down and stop the motor, the BRK mode will keep braking status.

5.7 Switching of rotation direction

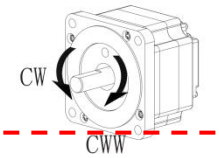
If a switch is installed between F / R terminal and GND terminal, the rotation direction of the motor can be simply switched

Disconnect: the motor rotates clockwise

Connection: motor rotates counterclockwise



※ According to the specifications of the motor (see the following figure on the right)



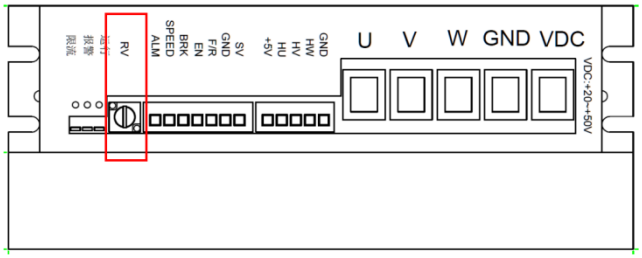
The factory setting is that the F / R port is not connected with the GND port, so the motor rotates clockwise when the power is input.

6 Speed Control

6.1 Built in potentiometer RV speed control

Turn the internal speed regulating potentiometer knob to the right, and the motor starts to rotate after the "click" sounds

If you rotate to the right continually, the motor speed will gradually rise. Turn to the left and the motor will slow down gradually. Then rotate to the left limit (click sound), the output to the motor becomes disconnected and the motor stops

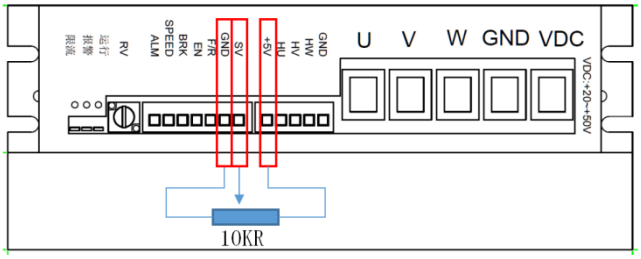


⚠ Attention: Please do not connect to SV port.

6.2 External analog speed control

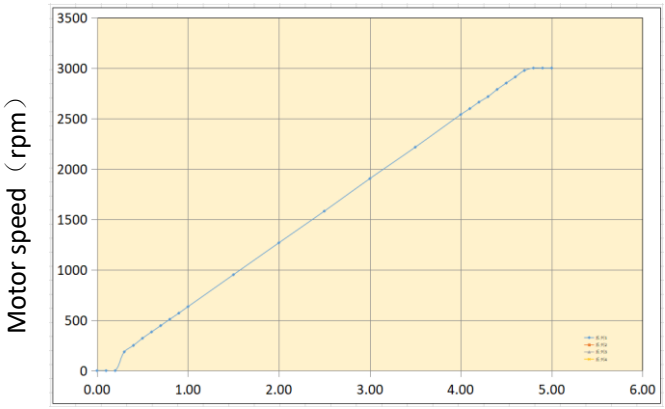
Please use 10KR potentiometer for speed regulation.

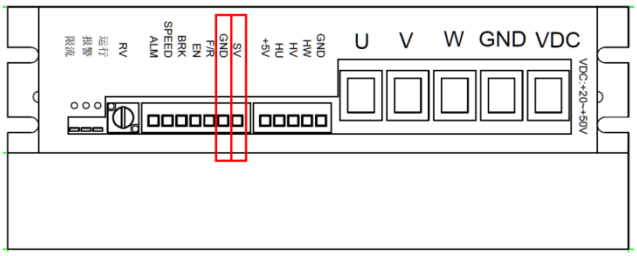
Be sure to connect the central pin of the potentiometer to the SV port, and the other pins to the GND port and + 5V port respectively



6.3 Analog DC 0 ~ 5V speed control

⚠ 1.Rotate the RV potentiometer to the "click" position to the left
2.Be sure to set the correct number of motor poles





Relationship between control voltage and motor speed（When the maximum speed is 3000rpm）

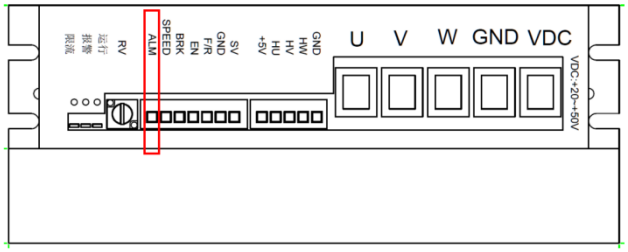
When the input voltage is 0.3V, the motor speed is 186rpm. When the input voltage is about 5V, the motor speed is 3000rpm.

※The above chart is the experimental chart.

7 Alarm indication and handling

7.1 Alarm indication

When the signal of Hall sensor is wrong due to over voltage and over temperature of motor, ALM port will be automatically connected to GND port, ALM port will change to low level, and the driver will stop working



Red light indication description			
Flicker times	**Alarm name**	**Description of abnormal state**	**Remark**
2	over temperature protection	PCB temperature over 85 ℃ detected	If an alarm occurs, please try to use shutdown to reset the alarm. After the motor stops, the alarm will be reset
3	over voltage protection	The power supply voltage exceeds 63v	
4	lower temperature protection	The power supply voltage is less than 14V	
5	Hall alarm	The driver received an incorrect Hall signal	
8	Under speed protection	Motor locked rotor, under speed or abnormal driving circuit	
10	Abnormal learning	An exception occurred when the driver learned the hall line sequence	
11-20	Drive damaged	Abnormal internal IO port detected during power on	
21-24	Storage exception	Storage exception detected	

Green light indication			
Signal		**Explanation**	**Remark**
Switch signal input	F/R	When the input state of the switch signal changes, the display state of the green light will change	Green light indicates priority: Switch signal input = analog signal input > Run > idle
	EN		
	BRK		
	SW1		
	SW2		
Analog signal input	RV	When the analog signal input state changes rapidly, the display state of the green light will change accordingly	
	SV		
	ACC		
	PCL		
Motor status	Run	cycling on for 0.5 seconds and off for 0.5 seconds	
	Free	On 0.99 seconds and off 0.01 seconds	

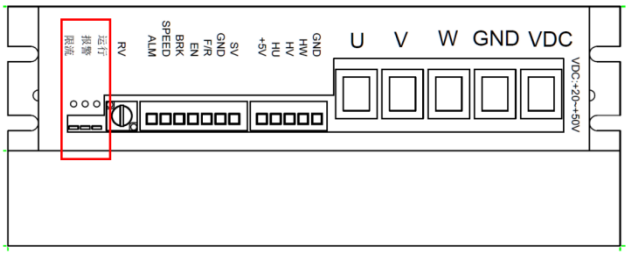
White light indication		
Status	**Explanation**	**Remark**
on	Current is limiting	The signal comes from hardware, and the signal is presented to the main chip and then the current is limited by the main chip
off	Current is not limiting	

7.2 Alarm processing

If the abnormality in the above table happen , please send a reset command to the driver to eliminate the alarm signal. If the alarm signal cannot be eliminated, deal with it according to the requirements in the following table.

The reset command refers to one of the following six commands

- ◆Set the internal potentiometer to zero
- ◆Set the external potentiometer to zero
- ◆EN disconnect
- ◆BRK connect
- ◆Communication stop motor
- ◆Power on again



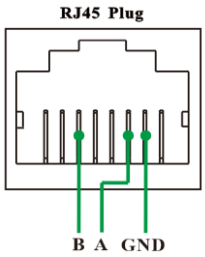
Red light exception handling			
Flicker times	**Alarm name**	**Description of abnormal state**	**Remark**
2	over temperature protection	Power on after the drive cools down	If an alarm occurs, please try to use shutdown to reset the alarm. After the motor stops, the alarm will be reset
3	over voltage protection	Please check the power supply voltage	
4	low voltage protection	Please check the power supply voltage	
5	Hall alarm	Please check whether the motor wiring is secure and ensure that the motor is not damaged	
8	Under speed protection	Please confirm whether the motor load is too large, and the motor is not damaged. If not, please replace another drive of the same type for experiment	
10	Abnormal learning	Check wiring, motor, etc.	
11-20	Drive damaged	Please contact your supplier	
21-24	Storage exception	Please power on again. If it still doesn't work, please contact your supplier	

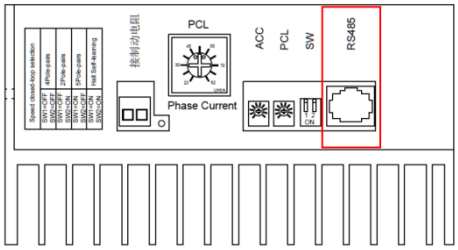
8 Modbus communication

8.1Communication interface and wiring mode

The communication function of the driver adopts Modbus protocol and conforms to the national standard GB / T 19582.1-2008. The two-wire serial link communication based on RS485 is used. The physical interface adopts RJ45. The terminal definition is shown in the figure below. Three wires need to be connected: B, A and GND (wiring is prohibited for other terminals in this RJ45 interface). The communication address is set through communication. The 120 Ω terminal matches the resistance and needs to be externally connected by the user.

Communication conditions	
Interface	RJ45
Bus	RS485
Agreement	MODBUS
Communication mode	half-duplex
Standard	GB/T 19582.1—2008
Communication rate	9600
data bit	8 bit
Stop bit	1 bit
Check out	Modbus CRC(Little Endian)
communication node	32





8.2 Read / write register address

Read									
Slave address (1byte)	**Function code (1byte)**	**Access address 1* (2byte)**	**Access address 2* (2byte)**	**Access data (2byte)**	**CRC Check code (2byte)**	**Read parameters**	**Value range**	**Default value**	**unit**
0Xnn	0X03 (Read data)	0X0000	0X0056	0X0001	CRC check out code	Set speed	0-Maximum speed limit	0	rpm
		0X0001	0X005F			Feedback speed	0-65535	0	rpm
		0X0002	0X0066			Motor status	0-3	0	-
		0X0003	0X0076			alarm code	0-24	0	-
		0X0004	0X0086			Pole of Pairs	1-65535	4	-
		0X0005	0X0090			Under speed time	0-65535	2	s
		0X0006	0X0092			Maximum speed limit	0-65535	3000	rpm
		0X0007	0X0096			Phase current limiting	22-82	82	A
		0X0008	0X0098			Acceleration and deceleration	0-150	6	0.1s
		0X0009	0X00A6			mailing address	1-247	1	-
		0X000A	0X00B6			Communication status	0-1	0	-
		0X000B	0X00BB			Program version	0-65535	-	-
		0X000C	0X00C8			Bus voltage	0-65535	480	0.1V
		0X000D	0X00D2			Driving temperature	-32768-32767	250	0.1℃
		0X000E	0X0129			Port indication	0-65535	-	-
0X0001.*: select one of access address 1 and access address 2. Access address 1 is convenient for continuous reading, and access address 2 is recommended to use 0x0001 for data access									

Read parameters	explanation
Set speed	is the value that communications write to the drive
Feedback speed	is the speed feedback by the motor
Motor status	0: stop; 1: Forward rotation; 2:Reversal; 3:brake
Alarm code	Please see the charter 7.2
Pole of Pairs	When the communication status is enabled, the value read is the value written by the communication, otherwise it is the value set by the SW dial code, that is, the value is always the value currently used by the driver
Under speed time	See description of write parameters
Maximum speed limit	See description of write parameters
Phase current limiting	The current limit value is set by the potentiometer, and it is normal if there is a slight deviation in the value range
Acceleration and deceleration	When the communication status is enabled, the value read is the value written by the communication, otherwise it is the value set by the ACC potentiometer, that is, the value is always the value currently used by the driver
mail address	See description of write parameters
communication status	See description of write parameters
program version	——
Bus voltage	If the read data is 0X01E0, the bus voltage is 48.0v
Driving temperature	This parameter is a signed number, that is, a 16 bit integer number; If the read data is 0xff9c, the maximum temperature of the drive is - 10.0 ℃
Port indication	See port instructions

Write

Slave address (1byte)	Function code (1byte)	Access address (2byte)	Access data (2byte)	CRC Check code (2byte)	Write parameters	Value range	Default value	unit	Save or not
0Xnn	0X06 (Write data)	0X0056	0X0BB8	CRC Check code	Set speed	0-Maximum speed limit	0	rpm	yes
		0X0066	0X0001		Control motor	0-3	0	-	yes
		0X0086	0X0004		Pole of Pairs	1-65535	4	-	yes
		0X0090	0X0002		Under speed time	0-65535	2	s	yes
		0X0092	0X0BB8		Maximum speed limit	0-65535	3000	rpm	yes
		0X0098	0X0006		Acceleration and deceleration	0-150	6	0.1s	yes
		0X00A6	0X0001		mail address	1-247	1	-	yes
		0X00B6	0X0001		Communication status	0-1	0	-	No
		0X0113	0X0001		factory reset	1	-	-	No
		0X0116	0X0001		Reset Program	1	-	-	No

Write parameters	explanation
Set speed	Setting the speed to less than 200 rpm is not recommended
Control motor	0: stop; 1: Forward rotation; 2: reversal; 3: brake
Pole of Pairs	Changing the number of poles during motor operation is not recommended
Under speed time	When the under-speed time is set to 0, the driver will not give an under-speed alarm
Maximum speed limit	It is recommended to set the maximum speed limit to the rated speed of the motor
Acceleration and deceleration	The acceleration and deceleration range set by hardware is 6-150, and the communication setting range is 0-150. It is recommended to increase this value appropriately in case of rapid braking with large inertia
mail address	It is not recommended to use broadcast mode to set the addresses of multiple drives at the same time
Communication status	0: Communication disable; 1: Communication enable (this parameter is not saved, and the communication status is disabled after each power on
factory reset	0: No effect; 1: The contents stored in the drive will be restored to the factory settings
Reset Program	0: No effect; 1: Reset (can be used to replace power on to restart the drive)

Port indication

bit31	bit30	bit29	bit28	bit27	bit26	bit25	bit24	bit23	bit22	bit21	bit20	bit19	bit18	bit17	bit16
bit15	bit14	bit13	bit12	bit11	bit10	bit9 SW2	bit8 SW1	bit7 ALM	bit6 SPEED	bit5 BRK	bit4 EN	bit3 F/R	bit2 HW	bit1 HV	bit0 HU
Note: bit31 to bit10 are standby															

Read / write register example			
Read register			remarks
Motor feedback speed	send	01 03 00 5F 00 01 B4 18	The motor speed is 548rpm
	receive	01 03 02 02 48 B9 12	
Write register			
Communication enable	send	01 06 00 B6 00 01 A9 EC	
	receive	01 06 00 B6 00 01 A9 EC	
Set motor speed	send	01 06 00 56 04 4C 6A EF	Set motor speed 1100rpm
	receive	01 06 00 56 04 4C 6A EF	
Set motor forward rotation	send	01 06 00 66 00 01 A8 15	
	receive	01 06 00 66 00 01 A8 15	

8.3 Program the CRC check code

The driver adopts CRC-16 / MODBUS algorithm model. For more details, please refer to appendix B.2 of GB / T 19582.2-2008. The C source program of generating check code is given below for users' reference.

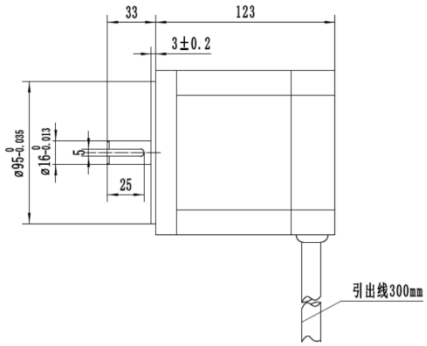
```
typedef unsigned char u8;
typedef unsigned int u16;
/**
*@brief Create check out code
*@param *ptr Saving inform code in the Number group which first address put in the ADU first byte
*@param length The Number of ADU exclude check out code
*@retval u16 Checkout code
*/
u16 getCRC16(u8 *ptr, u8 length)
{
    u8 i;
    u16 crc = 0xFFFF;

    if(length == 0)
        length = 1;
        while(length--) {
            crc ^= *ptr;
            for(i = 0; i < 8; i++)   {
                if(crc & 1)   {
                    crc >>= 1;
                    crc ^= 0xA001;
                }
                else
                    crc >>= 1;
            }
            ptr++;
        }
    return(crc);
}
```

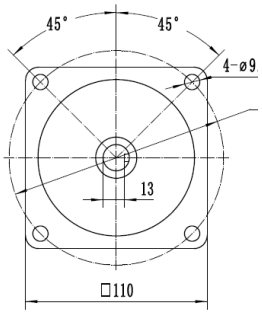
9 Common problems and Solutions

Fault phenomenon	Possible causes	Treatment method
Motor does not rotate	Driver alarm	Follow the alarm instructions
	There is a stop command	Provide motor operation command
	Abnormal wiring	Check wiring (including wire sequence)
	The holding brake of the motor is not opened	Open the motor holding brake
	Motor drive mismatch	The driver only supports motors with a Hall electric angle of 120 °
	Equipment damage	Replace the drive or motor
Motor overheating	Overload	Reduce load
	Excessive limiting current	Reduce limiting current
	Ambient temperature is too high	Strengthen environmental heat dissipation
	wiring error	Correct wiring
	Equipment damage	Replace the drive or motor
Abnormal motor speed	Overload	Reduce load
	Abnormal signal input	Check input signal
	Wrong pole pairs	Correct the pole pairs
	Wrong reduce ration	Calculate using the correct reduction ratio
	Wrong setting maximum speed	Set the maximum speed to the rated speed of the motor actually used
Abnormal noise during motor operation	wiring error	Correct wiring
	Motor drive mismatch	The driver only supports motors with a Hall electric angle of 120 °
	Lack of phase	Please check the motor wiring
	Load problem	Motor test without load
	Motor problem	Replace the motor
	Normal noise	Driving chopper noise and motor commutation noise are normal
Motor speed fluctuation	Abnormal signal input	Change to internal speed regulation experiment
	overload inertia	reduce load or add reducer
	Unstable load	Maintaining a steady load or normal condition
No output signal	pull-up resistor is not connected	Connect appropriate pull-up resistors to the alarm output interface and speed output interface
	Normal condition	Artificially create alarm or rotate the motor to check the signal output

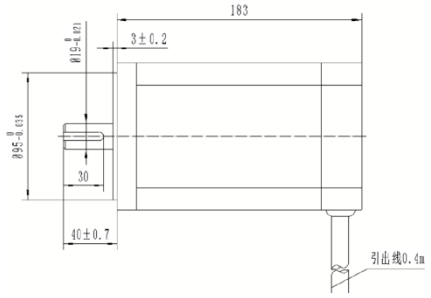
10 Recommended motors

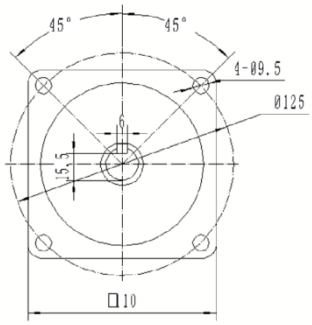
Model	Voltage(V)	Pole pairs	Rated speed(RPM)	Rated torque(N.m)	Output power(W)	Speed without load(rpm)
110BLF-8015LBB	36	4	3000±10%	5.3	800	3600±10%
110DMW120-17060	48	4	3000±10%	6.37	2000	3600±10%





Model：110BLF-8015LBB							
U	V	W	+5V	HallA	HallB	HallC	GND
Red thick line	Yellow thick line	Black thick line	Red thin line	Blue thin line	Green thin line	White thin line	Black thin line





Model：110DMW120-17060							
U	V	W	+5V	Hall A	Hall B	HallC	GND
Red thick line	Yellow thick line	Black thick line	Red thin line	Blue thin line	Green thin line	White thin line	Black thin line

After sales service

Warranty period

Dongguan ICAN Technology provides warranty for 1 year from the date of shipping.

Maintenance process

1 Get the maintenance permission.
2 Ship the package to the following address:
401, No2 Building, No7 Xinhe Shengfeng Road, Wanjiang Street, Dongguan City, Guangdong Province

Return Policy

1)After-use or man-made damage condition (etc., wrong wiring), no return.
2) ICAN Technology guarantees the product quality, but the product incompatibility is not in the return or maintain condition.
3)Customer don't use the product under the specified electrical performance and environment indicators, no maintain condition
4)Customers change the internal parts.